

**INSTREAM PUBLIC USES, OUTSTANDING
CHARACTERISTICS, AND RESOURCES OF THE LAMPREY
RIVER AND PROPOSED PROTECTIVE FLOW MEASURES FOR
FLOW DEPENDENT RESOURCES**

FINAL REPORT

NOVEMBER 2006



**INSTREAM PUBLIC USES, OUTSTANDING CHARACTERISTICS, AND
RESOURCES OF THE LAMPREY RIVER AND PROPOSED
PROTECTIVE FLOW MEASURES FOR FLOW DEPENDENT
RESOURCES**

FINAL REPORT

Prepared for
STATE OF NEW HAMPSHIRE
Department of Environmental Services

Prepared by
NORMANDEAU ASSOCIATES
University of Massachusetts
University of New Hampshire

November 2006



Table of Contents

	Page
1.0 INTRODUCTION AND PURPOSE	ERROR! BOOKMARK NOT DEFINED.
2.0 METHODS OF ASSESSMENT	ERROR! BOOKMARK NOT DEFINED.
2.1 OVERVIEW OF ALL POTENTIAL IPUOCRS	ERROR! BOOKMARK NOT DEFINED.
2.2 DRAFT LIST OF IPUOCR ENTITIES	ERROR! BOOKMARK NOT DEFINED.
2.3 LITERATURE REVIEW	ERROR! BOOKMARK NOT DEFINED.
2.4 CONSULTATION	ERROR! BOOKMARK NOT DEFINED.
2.5 FIELD SURVEY	ERROR! BOOKMARK NOT DEFINED.
2.6 DELINEATIONS OF SECTIONS AND REACHES	ERROR! BOOKMARK NOT DEFINED.
2.7 SCREENING METHODS	ERROR! BOOKMARK NOT DEFINED.
2.8 FLOW DEPENDENCE AND CRITICAL FLOW RELATED CHARACTERISTICS OF IPUOCR ENTITIES.....	ERROR! BOOKMARK NOT DEFINED.
3.0 DISCUSSION OF IPUOCR ENTITIES AND PISF METHODS.....	ERROR! BOOKMARK NOT DEFINED.
3.1 FLOW DEPENDENT IPUOCRS	ERROR! BOOKMARK NOT DEFINED.
3.2 NON-FLOW DEPENDENT ENTITIES	ERROR! BOOKMARK NOT DEFINED.
4.0 REFERENCES.....	ERROR! BOOKMARK NOT DEFINED.

APPENDICES:

Appendix A: Fish and Invertebrate Species, Characteristics, and Habitat

List of Figures

		Page
Figure 2-1.	Locations of dams and other features in the Lamprey River watershed.	Error! Bookmark not defined.
Figure 2-2.	Locations of NWI Wetlands and Natural Heritage data. ..	Error! Bookmark not defined.
Figure 2-3.	Locations of the seven sections identified for the Lamprey River designated segment.	Error! Bookmark not defined.
Figure 2-4.	Flow chart of IPUOCR screening process.....	Error! Bookmark not defined.
Figure 3-1.	Initial bio-periods developed for the Lamprey River plotted over 71-year daily mean hydrograph.....	Error! Bookmark not defined.
Figure 3-2.	The habitat survey delineates hydromorphologic units and their physical attributes (top left). The fish survey is combined with this to identify key habitat attributes affecting fish (top right). The model calculates the probability of fish presence in each habitat and delineates areas of suitable and unsuitable habitat.	Error! Bookmark not defined.
Figure 3-3.	Schematic of mapping procedure planned for the Lamprey River.	Error! Bookmark not defined.
Figure 3-4.	(left to right) 1. Black and white aerial imagery, 2. An initial segmentation, 3. Iterations of the algorithm 4. A “perfect” hand generated segmentation.	Error! Bookmark not defined.
Figure 3-5.	Results of scuba investigation of one impoundment on the Souhegan River.	Error! Bookmark not defined.
Figure 3-6.	CUT curves from habitat time series (source: Capra et al., 1995).	Error! Bookmark not defined.
Figure 3-7.	Continuous Under Threshold duration (CUT) curves representing percentages of available habitat area for adult resident fish in the Quinebaug River during the summer season (Parasiewicz 2005).	Error! Bookmark not defined.
Figure 3-8.	Layout of transects.	Error! Bookmark not defined.
Figure 3-9.	Transect habitat mapping.	Error! Bookmark not defined.
Figure 3-10.	Habitat under different flows.	Error! Bookmark not defined.
Figure 3-11.	Relative change between flow regimes.	Error! Bookmark not defined.
Figure 3-12.	Habitat suitability under different flows.....	Error! Bookmark not defined.

List of Tables

	Page
Table 2-1. Matrix of IPUOCR's including flow dependence, reason for inclusion, critical seasons, life stages and method of assessment.	Error! Bookmark not defined.
Table 3-1. Fish Stocked in the Lamprey River in 2005.	Error! Bookmark not defined.
Table 3-2. Summary of Lamprey Fish Assemblage (August 25-29, 2003) (NHDES 2005).	Error! Bookmark not defined.
Table 3-3. IHA statistics for the Lamprey River for the Period of 1934 to 1976 and Their Comparison with Calculated Stress Thresholds.	Error! Bookmark not defined.

Glossary

ACOE	U.S. Army Corps of Engineers
ADO	Affected dam owner
AMC	Appalachian Mountain Club
AWU	Affected water user
BSI	Basin stress index
cfs	Cubic feet per second
cfs/m	Cubic feet per second per square mile
CUT	Continuous under threshold
FTM	Floodplain transect method
GIS	Geographic information system
GPS	Global positioning system
HMU	Hydromorphological unit
IHA	Indicators of hydrologic alteration
IPUOCR	Instream public uses, outstanding characteristics and resources
LBFC	Lamprey baseline fish community
MesoHABSIM	A computer simulation of meso-scale habitat
NAI	Normandeau Associates, Inc.
NFP	Natural flow paradigm
NHDES	New Hampshire Department of Environmental Services
NHF&GD	New Hampshire Fish & Game Department
NHI	Natural heritage inventory
NHNHB	New Hampshire Natural Heritage Bureau
NRCS	Natural Resources Conservation Service
PHABSIM	Physical habitat simulation model
PISF	Protected instream flow
POTW	Publicly owned treatment works
RSA	Revised statutes annotated
RTE	Rare, threatened and endangered species
TFC	Target fish community
TMDL	Total maximum daily load
TRC	Technical review committee
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WMP	Water management plan
WMPA	Water management planning area
WMPAAC	Water management planning area advisory committee
WWTP	Wastewater treatment plant